Central Hydraulics Valve for Tractors with Priority Function for Steering, Trailer Brake and Pilot Oil Valve

Type LT 43

Series 2X
Maximum system pressure 250 bar

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Characteristics

- Input element with priority and pilot oil valve for steering and trailer brake
- Trailer brake with priority function for steering valve
- Closed centre load sensing principle
- Variant from the valve series „Central hydraulics“ to RD 66105
### Functional description and potential applications

This valve was developed for use on tractors. It works on the closed centre load sensing principle and is matched to the pump series AA10VO. It comprises two valve spools each with two piston axes. On the tractor the steering valve and brake pipe connection to the trailer brake are supplied as priority over the low pressure actuators (transmission control, pilot oil circuit) and other high pressure actuators (directional valves, lifting gear valve). The subplate mounting enables the LT 41 valves (priority and pilot oil valve) and LT 42 valves (priority and trailer brake valve) to be connected to the compact block. 

For further information on possible expansion stages of the central hydraulics valve series see RE 6605.

The valve spool on the tractor accommodates the connection lines from and to the control pump. The priority valve (1) directs the flow to the second spool with priority valve (4) for steering, and also to the trailer brake valve (6). When the steering valve and the trailer brake valve have been sufficiently supplied, the priority valve (1) directs the remaining pump flow to the pilot oil valve (2) downstream. This acts likewise as a priority valve for the low pressure actuators and the pilot oil circuit. This ensures that even if the pressure collapses in the high pressure circuit AUX (e.g. hydraulic motors running unloaded) the hydraulic couplings and brakes are sufficiently supplied with operating pressure, thus preventing any potentially dangerous situations caused by uncontrolled operating state.

The priority valve (1) is controlled as a result of the pressure drop at the steering valve and trailer brake valve actuators. This causes the load sensing pressure $X_{ST}/X_{TB}$ to act on the spring side of the priority piston (1.1), a signal being then transmitted via the cartridge valve (6). On the opposite side of the piston the supply pressure of these actuators acts via a nozzle // reversing valve combination. The function of the nozzle is to retain a continuous pressure, allowing only the minimum flow required to dampen piston movement and have a stabilising effect. The check valve, on the other hand, permits fast movement of the piston towards the priority operation to meet the dynamic requirements of the steering operation.

The pressure drop set by the control spring (1.2) corresponds to the pressure drop at the steering valve (spring (4.2)) and also to the control pressure difference of the AA10VO flow controller.

The downstream pilot oil valve (2) acts fundamentally as the priority valve described.

The differences are as follows:

- The valve spring does not control the pressure difference via an actuator, it controls the constant pressure $p_1$ for the low pressure and pilot oil circuits.
- There are no special dynamic requirements for the steering operation, and therefore no check valve is required.

The load pressures of the priority actuator and of the downstream actuators are compared in the cartridge valve (3) and the resulting signal passed on to the control pump.

The priority steering valve and trailer brake actuators are controlled by means of the priority valve (4). Output $P_{ST}$ to the steering valve has priority over the supply of the trailer brake valve. This acts as a pressure reducing valve with a legally stipulated maximum pressure.

The pressure drop causes the priority valve (4) to be controlled via the steering valve (between $P_{ST}$ and $X_{TB}$). The load sensing pressure $X_{ST}$ of the steering valve acts on the spring side of the priority spool (4.1), the steering valve supply pressure $P_{ST}$ acting on the opposite side via a nozzle/check valve combination. The function of the nozzle is to retain a continuous pressure, allowing only the minimum flow required to dampen piston movement and have a stabilising effect. The check valve, on the other hand, permits fast movement of the piston towards the priority operation to meet the dynamic requirements of the steering operation. Should the pressure difference between $P_{ST}$ and $X_{ST}$ lie below the value preset by the spring (4.2), supply to the trailer brake valve will be throttled to ensure a minimum pressure drop via the steering valve. The threshold for throttling the secondary flow corresponds to the control pressure difference of the flow control on the axial piston pump AA10VO and the control pressure difference of the priority valve in LT 41. If the pressure drop at the steering valve is a certain amount above the given control pressure difference at the valve, the pump pressure to port $P_{ST}$ will be throttled by the priority valve, so that the predetermined maximum pressure drop from $P_{ST}$ to $X_{ST}$ is not exceeded (compensation operation). A small flow will continuously be fed from pressure port $P_{ST}$ into the load sensing line $X_{ST}$ by means of the nozzle (4.3). Load sensing is more independent of temperature fluctuations and a constantly full load sensing line is ensured. Both result...
Functional description and potential applications

in a short reaction time from pump and priority valve. The nozzle (4.3) also undertakes the task of unloading the P_ST port in case the steering valve does not use any oil and the downstream trailer brake valve is working in high pressure conditions.

The hydraulically controlled trailer brake valve acts as a proportional pressure reducing valve. Oil coming from the priority valve is redirected with minimal loss to port TB and pressure head $p_{TB}$ proportional to control pressure SI is kept constant. The control pump receives the information regarding pressure requirement of the trailer brake via the signal chain of dynamic nozzle (7) and cartridge valve (6).

Signal pressure SI corresponds to the brake pressure of the tractor. It acts on the transmission spool (5.2) and by means of the spring (5.3) moves the control spool (5.1) until the pressure forces on the front side of the control spool oppose the transmission spool are equal to the forces on the transmitter side.

The legal requirements (89/73/EEC) stipulate a maximum pressure of 100 to 150 bar in port TB. As the tractor brake pressure SI is, however, much lower, a pressure transducer is fitted at the control spool. Maximum pressure limit at port TB must be independent of signal pressure SI. This function is taken on by the spring (5.3), which, as a rigid transmission element, first transmits the signal forces directly with low signal pressures SI, only being compressed at higher signal pressures, thus limiting the transmittable force to the prescribed maximum.

A bleed valve (5.4) for the transmission line is built into the movable transmitter section.

Note!
System stability may be affected if unstable pressure relief valves are used in the load sensing lines.

Legal requirements for the control of steering and trailer brake:

- 75 / 321 EEC Steering
- § 38 StVzo Steering
- 71 / 320 EEC Brake system powered vehicles and trailers
- 76 / 432 EEC Brake system locomotives - tractive machines
- 89 / 173 EEC Control of trailer brake
- ECE 13 Operating permission, modifications

It is recommended that the following standards be applied and adhered to:

- ISO 5676 Tractors und machining for agriculture and forestry-Hydraulic coupling-Braking circuit
- ISO 5696 Brakes for trailers, Testing
- ISO 5697 Agricultural vehicles, Brake power

Symbol

\[
\begin{align*}
\text{SI} & \rightarrow \text{TB} \\
\text{P}_{\text{IN}} & = \text{Pump} \\
\text{P}_{\text{AUX}} & = \text{Directional valves} \\
\text{P}_{\text{ST}} & = \text{Low pressure actuator} \\
\text{TB} & = \text{Brake} \\
\text{P}_{\text{ST}} & = \text{Steering} \\
\text{X}_{\text{ST}} & = \text{Load signal steering} \\
\text{X}_{\text{AUX}} & = \text{Load signal directional valves} \\
\text{X}_{\text{LS}} & = \text{Load signal} \\
\text{T} & = \text{Tank} \\
\text{SI} & = \text{Pressure transmitter}
\end{align*}
\]
### Technical data (for operation outside these parameters please consult us)

#### general
- **Weight**
  - $m$ kg: 18.4
- **Installation position**: optional
- **Umgebungstemperaturbereich**: $\vartheta$ °C
  - –30 to +80

#### hydraulic
- **System pressure**
  - $p$ bar: 210 (max. 250)
- **Press. peaks**
  - $p$ bar: 290
- **Transmitter pressure, max.**
  - $p$ bar: 100
- **Fluid**
  - Mineral oil (HL, HLP) nach DIN 51524
  - Other pressure fluids on request
- **Fluid temperature range**
  - continuous $\vartheta$ °C: +20 to +90
  - short-time $\vartheta$ °C: –30 to +100
- **Viskosity range**
  - $\nu$ mm²/s: 10 to 380
- **Max. permissible degree of contamination of the hydraulic fluid**
  - Class 18/15
- **Cleanliness class to ISO 4406 (c)**
Power data (measured at HLPD 32, $\theta_{oil} = 50 \, ^\circ C$)

Transmission:
- Transmitter pressure/outlet pressure at socket of trailer brake valve
  - Standard 1:11
  - Other transmission ratios on request
  - Design limit 1:7

Capacity:
- Transmission section, max. 1.5 mL

Priority valve

\[
\Delta p = p_{Prio} - X_{Prio} \text{ in bar}
\]

<table>
<thead>
<tr>
<th>Priority operation</th>
<th>max.</th>
<th>0</th>
<th>14.6</th>
<th>11.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow control operation</td>
<td>0</td>
<td>0</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Compensation operation</td>
<td>0</td>
<td>max.</td>
<td>26.8</td>
<td>20.3</td>
</tr>
</tbody>
</table>

\[
p_{V_{max}} \quad p_{V_{aux}} \quad 1 \quad 4
\]

\[
\Delta p \quad \text{Priority valve}
\]

Throttle curve of priority valve

\[
\Delta p = p_z - p_{aux} \text{ in bar}
\]

\[
q_{V_{aux}} \text{ in l/min}
\]

Transmission:
- Transmitter pressure/outlet pressure at socket of trailer brake valve
  - Standard :\( \frac{1}{11} \)
  - Other transmission ratios on request
  - Design limit :\( \frac{1}{7} \)

Capacity:
- Transmission section, max. 1.5 mL
Unit dimensions (in mm)

1. Dimensions apply to all ports
2. Valve fixing screws M8x140 DIN ISO 4762-8.8
   $M_a = 25$ Nm (order separately)
3. Nameplate

For mounting area and threaded ports see page 7
Unit dimensions (in mm)

Mounting area

Thread connections

<table>
<thead>
<tr>
<th>Port</th>
<th>d1</th>
<th>Ød2</th>
<th>Ød3</th>
<th>t2</th>
<th>t3</th>
<th>a</th>
</tr>
</thead>
<tbody>
<tr>
<td>P_IN</td>
<td>M33x2</td>
<td>35.4</td>
<td>48</td>
<td>3.1</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>P_AUX</td>
<td>M33x2</td>
<td>35.4</td>
<td>48</td>
<td>3.1</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>P_1</td>
<td>M22x1.5</td>
<td>23.8</td>
<td>34</td>
<td>2.4</td>
<td>15.5</td>
<td>15</td>
</tr>
<tr>
<td>TB</td>
<td>M22x1.5</td>
<td>23.8</td>
<td>34</td>
<td>2.4</td>
<td>15.5</td>
<td>15</td>
</tr>
<tr>
<td>P_ST</td>
<td>M22x1.5</td>
<td>23.8</td>
<td>34</td>
<td>2.4</td>
<td>15.5</td>
<td>15</td>
</tr>
<tr>
<td>X_ST</td>
<td>M14x1.5</td>
<td>15.8</td>
<td>25</td>
<td>2.4</td>
<td>11.5</td>
<td>15</td>
</tr>
<tr>
<td>X_AUX</td>
<td>M14x1.5</td>
<td>15.8</td>
<td>25</td>
<td>2.4</td>
<td>11.5</td>
<td>15</td>
</tr>
<tr>
<td>X_LS</td>
<td>M14x1.5</td>
<td>15.8</td>
<td>25</td>
<td>2.4</td>
<td>11.5</td>
<td>15</td>
</tr>
<tr>
<td>SI</td>
<td>M14x1.5</td>
<td>15.8</td>
<td>(25)</td>
<td>2.4</td>
<td>12</td>
<td>15</td>
</tr>
</tbody>
</table>

4 Mounting area
5 Ports T and T₀ should be preferably under oil
6 Valve fixing bores